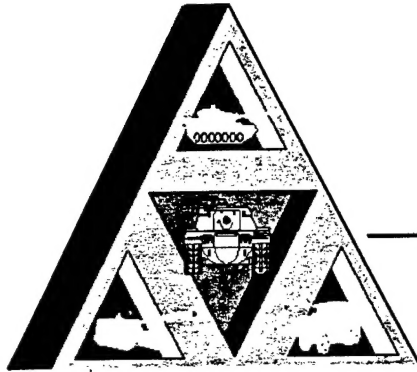


TARDEC



Technical Report

No. 13651

Market Analysis for the Packaged Water System Program

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June 1996

By Kimberly Dailey

Distribution limited to Government only.



U.S. Army Tank-Automotive Command
Research, Development and Engineering Center
Warren, Michigan 48397-5000

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No. 13651

Market Analysis for the Packaged Water System Program

January 1996

By Kimberly Dailey
USA Tank Automotive Command
Mobility Technology Center, Belvoir
Water and Wastewater Treatment Team

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Executive Summary

This report documents the results of a market survey on Packaged Water Systems (PWSs). The survey was conducted by the Fuel and Water Supply Division at the Mobility Technology Center - Belvoir, Fort Belvoir, VA and includes evaluation of devices that are commercially available in the United States and foreign markets. This evaluation is based on the performance and whether the requirements set forth by the US Army Mission Needs Statement (MNS) and the draft Operational Requirements Document (ORD) for PWS are met.

The market survey revealed that there were a number of commercially available systems with the potential to meet the Army's requirements. The capabilities of the systems represented in the survey were similar, however, each has specific advantages and disadvantages.

Section 1 Introduction

OBJECTIVE

The objective of this Market Survey was to determine if there are commercially available portable, water packaging systems. The U.S. Army can use the systems to increase the ability of water supply units to store and distribute sufficient quantities of potable water to meet expected consumption rates.

SCOPE

The scope of this market survey included performing the following activities:

1. identification of commercial sources.
2. development of initial and follow-up market analysis questionnaires.
3. distribution, collection and analysis of data from the questionnaires.

Section 2 Background

MILITARY REQUIREMENT

The Packaged Water System (PWS) will be used to resupply combat forces with drinking water during early entry and prior to arrival of combat service units. These missions, such as early entry and disaster relief operations, are carried out by small units and detachments with minimal logistics support. The units must either carry all of their required water with them, obtain it from the host nation or be re-supplied by airdrop. Host nation support may not always be available, transport of water is heavy along with bulky (often impractical) and air re-supply is rather expensive.

The U.S. Army established the requirement for a Packaged Water System (PWS) in the approved U.S. Army Mission Needs Statement (MNS) for Packaged Water (PW), dated 10 October 1993 (Army Cards No. 26-93).

ESSENTIAL CHARACTERISTICS

The Mobility Technology Center - Belvoir (MTC-B) will use the results of this Market Analysis to select several systems for technical evaluation. The purpose of this evaluation will be to examine the operational characteristics and capabilities of the systems. The main characteristics to be considered include: operability, reliability, and maintainability.

The PWS Program is a Non-Developmental Item (NDI) Program. Thus, the systems chosen for evaluation by MTCB must be available for sale to the public, as an off-the-shelf item.

The following list of essential PWS characteristics is based on the Army's MNS and the draft Operational Requirements Document (ORD). The first eight characteristics were used to evaluate the market survey responses. All fourteen will be used to evaluate the systems during the test portion of the program.

Weight: The PWS and accompanying packaging material will be capable of being transported in the 5 - ton cargo truck.

System Size: The PWS shall be transportable in no more than 2 Tricon (8' x 8' x 8') containers.

Operational Environment: The PWS shall be operable and maintainable in climactic design type cold (within a heated shelter), basic and hot as defined in AR 70-38.

Logistics Support: The PWS shall not constitute an unreasonable burden to the Army supply system in terms of replacement of disposable or required items.

Power Requirements: The PWS shall be compatible with standard military power generation equipment or be self-powered.

Commercial Availability: The PWS shall be available, as an off the shelf item, for sale to the public.

Number of Hours of Self-Sustained Operation: The number of hours of continuous operation of the system without maintenance.

Ease of Operation: The PWS shall be easily operated by the 5th through the 95th percentile soldiers, given proper training.

Facilitates Mass Production: The PWS shall facilitate mass production techniques with minimal manual labor.

Range of Container Sizes: The PWS shall be capable of filling container sizes ranging from 2 - 6 gallons.

Durability of Containers: The containers used shall be durable enough to withstand the rigors of being stacked or containerized for shipment, storage and issue as Class I or II dry cargo.

Ease of Access and Reseal of Containers: The containers shall enable the soldier to access and reseal the water without excessive spillage, leakage or contamination.

Maintainability: The PWS shall be easily maintained by the 5th through the 95th percentile soldiers given proper training.

Safety: The PWS shall present no uncontrolled safety hazards to military personnel.

Section 3 Study Approach

The study was divided into the three tasks described in Section 1, under the Scope. The following paragraphs provide descriptions of the work accomplished under each task.

IDENTIFICATION OF COMMERCIAL SOURCES

The initial process for identifying commercial sources included use of resources such as a trade association for the packaging industry called Packaging Machinery Manufacturers Institute (PMMI), the Thomas Register and a market investigation report titled "Family of Packaged Water/Packaged Water System" developed in 1994 by Diane Wood for the US Army Natick, Research, Development and Engineering Center. A Commerce Business Daily (CBD) Announcement along with an advertisement in two periodicals, Beverage Industry and Beverage World, were utilized to solicit information from interested companies with products that have the potential to meet the Army's requirements for a PWS. The announcement appeared in the May and August 1994 issues of the CBD, the May 1994 issue of Beverage Industry and the June and July 1994 issue of Beverage World. Copies of the advertisements are included in Appendix A.

A total of nineteen companies either responded to the advertisements or were contacted by phone. These companies were forwarded the questionnaires and are listed in Appendix C.

DEVELOPMENT OF THE MARKET SURVEY QUESTIONNAIRES

MTC-Belvoir developed an initial and follow up market survey questionnaire to identify the commercially available systems, define their capabilities and obtain leasing information.

The questionnaires also requested operational and cost information that allowed MTC-Belvoir to determine the actual availability of the systems. A copy of both questionnaires is included in Appendix B.

DISTRIBUTION AND COLLECTION OF DATA FROM THE MARKET SURVEY

The reproduction, assembly and distribution of the questionnaires occurred during the March 1994 - May 1995 timeframe. The companies were asked to respond as soon as possible for both surveys. All responses were received by September 1995.

Of the nineteen initial questionnaires mailed, eleven responses were received. The follow-up questionnaire was mailed to these eleven companies and five responses were returned.

The companies that responded favorably to both questionnaires are as follows:

Crandall Filling Machinery Inc.

General Packaging Equipment Co.

Heisler Industries, Inc.

Integrated Filling Systems

Scholle Corporation

RESULTS OF THE ANALYSIS OF THE QUESTIONNAIRES

This section examines and evaluates each of the five candidates in relation to the evaluation criteria presented in Section 2, under Essential Characteristics. The key features of each system are summarized in Table 1. A score of satisfactory (S), non-satisfactory (NS), not available (N/A) or no response provided/insufficient information provided (?) was assigned to each criteria depending on the capability of the system being evaluated. These scores are summarized in Table 2.

TABLE 1: PWS PHYSICAL CHARACTERISTICS

Company Name	System Weight (lbs)	System Dimensions (LxWxH)	Power Requirement	Container Type	Fill Rate contain/hr	No. of Persons Required for Operation	Operation Set-Up Time	Skills for Operation	System Cost
Crandall Filling Machinery, Inc.	1575	79" x 42" x 75"	1/3 or 1/4 HP motor requires 5.5 amps (Pneumatically operated unit requires air compressor - 5.6kg/sq cm)	Polyethylene bag in corrugated box, metal, glass or plastic	1 gal-720/hr 6 gal-480/hr	2 persons	1-2 hours	Basic knowledge of pneumatic components, electrical and motorized equipment	\$25,300
General Packaging Equipment Co.	3400	49" x 42" x 86" (plus a 6'-8' conveyor)	7 kva	Laminated plastic bags	1 gal-1080/hr 2 gal-660/hr	2 persons	30 minutes	Basic knowledge of electrical, mechanical and hydraulic components	\$51,802
Heisler Industries, Inc.	5000	32' x 6' x 6' Incorporated within a 40-foot covered trailer	220/440 volts, 3 phase, 6 cycle	Plastic pails with or without pop-up spouts	5 gal-600/hr	3 persons	15-30 minutes	Mechanical knowledge and skills along with operation training	\$250,000
Integrated Filling Systems	N/A	Can be incorporated within a 40-foot trailer	An on board diesel generator	Polyethylene bag in corrugated box	6 gal-600/hr	3 persons	30 minutes	Basic mechanical skills and electronic knowledge	?
Scholle Corporation	400	21" x 43" x 53"	110 volts, 60 hertz, 5 amps	Polyethylene bag in corrugated box	6 gal-300/hr	2 persons	2 hours	Simple mechanical skills	\$9,300

TABLE 2: PWS ESSENTIAL CHARACTERISTICS

Company Name	Weight (lbs)	Dimensions (LxWxH)	Operational Environment	Logistics Support	Power Requirements	Commercial Availability	No. Hours of Continuous Operation	Ease of Operation	Facilitates Mass Production	Range of Container Sizes	Durability of Containers	Ease of Access & Reseal of Containers	Maintainability	Safety
Crandall Filling Machinery, Inc.	S	S	S	S	S	S	S	S	S	S	S	S	S	S
General Packaging Equipment Co.	S	S	S	S	S	S	?	S	S	NS	S	S	S	S
Heister Industries, Inc.	NS	NS	S	S	S	S	?	S	S	S	S	S	S	S
Integrated Filling Systems	NS	NS	S	?	?	NS	S	S	S	S	S	S	NS	S
Scholle Corporation	S	S	S	S	S	S	S	S	S	S	S	S	S	S

KEY:

S = Satisfactory

NS = Not Satisfactory

? = No Information Provided

Manufacturer: Crandall Filling Machinery, Inc.
1392 Niagara Street
Buffalo, NY 14213-1393
Phone: (716) 885-2228, Fax: (716) 882-6649

Model Name(s): U4/25MTX and U4/25PTX

General Information: Crandall Filling Machinery, Inc. has been a pioneer in the design and manufacture of liquid filling machinery for the food, chemical, paint and petroleum industries for nearly a century.

Principles of Operation: The U4/25MTX filler has the capacity to fill 1-to 5 gallon (4 to 25 liters) metal, glass, plastic or bags in-box containers. The production rate for 1 gallon containers is 720 containers/hour and for 5 gallon containers is 480 containers/hour. The systems include stainless steel contact parts, four filling nozzles, in appropriate sizes and a welded steel frame. The U4/25MTX model utilizes a standard mechanical tripping device whereas the U4/25PTX model uses a pneumatic system, pneumatic filter, regulator and lubricator. The pneumatically operated machines have slightly higher production rates.

The operator places any empty container on the first filling platform and starts the fill. He continues to load and start the fill on all filling platforms. As each filling platform reaches its target weight, its nozzle closes. When a nozzle closes, the operator pushes the filled container to the discharge conveyor, loads an empty container, and starts the fill. For short runs, all nozzles need not be used.

Optional Features Include the Following:

Rollers on Filling Platforms: Recommended when all containers to be filled are 4 liters (1 gallon) or larger. Rollers ease the discharge of containers.

Motorized Discharge Conveyor: Recommended to ease the discharge of filled containers and quickly remove them from the filler.

Sanitary Valving and Piping: (Pneumatically Operated Models Only) The 3A sanitary stainless steel contact parts with clamp connectors provide rapid cleaning for food applications.

Dribble Flow Shut-Off: To increase fill accuracy, the Dribble Flow Shutoff will reduce the flow rate at the end of fill.

Advantages:

Utilizes type of containers (bag-in-box) that meet the Army's requirements – flexible, disposable and stackable.

2-person operation.

Commercially available off-the-shelf equipment.

Easy to operate and maintain for those with basic skills and knowledge of pneumatic or mechanical components and motorized equipment - No specialized training needed.

Meets the Army's size and weight requirements.

Noise control on the pneumatically operated models provide noise level at < 20dB.

Disadvantages:

The equipment cannot be leased.

Requires an air compressor for the pneumatically operated models in addition to power for the discharged conveyor.

Set-up time is rather lengthy (1-2hrs).

Manufacturer: General Packaging Equipment Company
6048 Westview Drive
Houston, TX 77055
Phone: (713) 686-4331, Fax: (713) 683-3967

Model Name(s): 70LC and 80LC

General Information: General Packaging Equipment Company has extensive experience in the packaging of water. They manufacture machines for automatic formation and filling of pouches of water for survival kits – utilized and approved by the U.S. Coast Guard. In addition, they have built a 1-liter packaging machine for the Canadian Army which was tested in Rwanda and is destined for Bosnia.

Principles of Operation: The 70LC and 80LC models are vertical form, fill and seal machines that package liquids in polyethylene bags. The major components of the system include the filler, film unwinder, bag folder, bag back sealer, and end sealer cutoff. Provided the system is mounted inside of a container, the operation can be stopped, cleaned and packed for shipment and storage within an hour. Temperatures below 45°F necessitate a start-up procedure for warming the hydraulic fluid to maintain a constant flow rate unless the machine is equipped with a hydraulic tank heater. None of the components of the system require calibration other than adjustments made on the machine. The equipment has been on the commercial market for 41 years with 1300-1400 machines presently in operation.

Advantages:

Well established company with commercially available systems.

Simple to operate and maintain.

An available leasing agreement.

Disposable containers.

Disadvantages:

The plastic bags are more vulnerable to puncture than other more sturdy containers.

The container size range of 1-2 gallons only meets the lower end of the required range of 2-6 gallons.

The number of hours of self-sustained operation was not provided.

Manufacturer: Heisler Industries, Inc.
224 Passaic Avenue
Fairfield, NJ 07004-3581
Phone: (201) 227-6300, Fax: (201) 227-7627

Model Name(s): SYS 1044

General Information: Heisler has been manufacturing automatic packaging equipment for over 75 years.

Principles of Operation: The SYS 1044 model utilizes plastic pails with or without a pop-up spout. The entire system is transportable within a 40 foot enclosed trailer. Major components of the system include a pail denester, a filler and a lid placer. The production or fill rate for the system is roughly 600, 5-gallon containers per hour (3,000 gallons/hour). Power requirements are 220/440 volts, 3 phase, 6 cycle along with an air compressor.

Advantages:

Commercially available equipment with proven capabilities.

Durable, stackable and spill resistant containers are utilized.

General knowledge and operation of equipment requires approximately 40 hours of on-the-job (OJT) training.

Disadvantages:

The size and weight of the system (within a 40 foot trailer) is not within the Army's requirements.

No details on the size of the compressor needed.

The pails and lids may add considerably to the logistics support requirements.

Manufacturer: Integrated Filling Systems
3555 So. Sunny Slope Road
New Berlin, WI 53151
Phone: (414) 821-0998, Fax: (414) 363-6628

Model Name(s): Containerized Filling System

General Information: Integrated Filling Systems is a new company formed by four key people with a combined total of over 60 years of experience in package filling machinery.

Principles of Operation: Integrated Filling Systems custom designs the equipment to meet the specifications and the end user's needs. The production rate for the system using 6-gallon bag-in-box containers would range from 500 - 600 containers/hour. A 40-foot container for intermodal service would be utilized to house the system. Major components of the system include conveyors, a multihead inline filler, a single head capper, a product head tank, a sterile air system, a clean in place system, a diesel engine driven generator and a climate control system. The filling head inflates the plastic bag with sterile air prior to filling and the head capper moves down to seal the bag. The system does require calibration at periodic intervals of six months for level, pressure and temperature sensors along with the digital magnitude flow meter. Skills needed to operate and maintain the equipment include average mechanical knowledge and understanding of control panel functions. An electronics technician or trained person is required to understand and program Programmable Logic Controls (PLCs).

Advantages:

Disposable, flexible and stackable containers are utilized (bag-in-box).

Climate controlled environment.

Disadvantages:

Not commercially available, off-the-shelf item. The equipment is custom designed to requirements.

An electronics technician or trained personnel is needed for maintenance of the PLCs.

The size and weight of the system is not within the Army's requirements.

Periodic calibrations are required.

Manufacturer: Scholle Corporation
200 W North Avenue
Northlake, IL 60164
Phone: (708) 562-7290, Fax: (708) 562-6579

Model Name(s): AF9D

General Information: Scholle Corporation invented and pioneered the development of bag-in-box packaging over 30 years ago.

Principles of Operation: The AF9D is a very simplistic system consisting mainly of a filling mechanism. The production rate is approximately 350, 5-gallon bag-in-box containers/hour. Only one person is required to set up and operate the system and simple mechanical skills are required for maintenance. The size and weight of the system is such that it can be easily stored and transported within a Tricon container (8' x 8' x 8'). No calibrations are required.

Advantages:

Simple to operate and maintain.

An available leasing program.

Commercially available, off-the-shelf equipment.

Disposable, flexible and stackable containers are utilized (bag-in-box).

Disadvantages:

No mention of a conveyor system - which would appear to overwork the operator.

The system requires an extensive time period (8 hours) for cleaning and packing.

Section 4 Discussion of Results

The results of the questionnaire response analysis has been compiled into tabular form and can be found in Table 2. The analysis suggest that the following manufacturers are currently producing commercially available, off-the-shelf models:

Crandall Filling Machinery, Inc.
General Packaging Equipment Company
Heisler Industries, Inc.
Scholle Corporation

The majority of the criteria in Section 2, under Essential Characteristics, is met by the above listed companies. Integrated Filling Systems designs equipment to fit the customer's requirements and is not an off-the-shelf item.

The above units appear to be simple to operate and maintain – meaning that basic mechanical and electrical skills are sufficient to properly sustain the equipment. All expressed the requirement of 2-3 people for set-up and operation along with the ability to mass produce and operate continuously (10 hour shift) with little or no maintenance. Also, the power requirements for these systems are compatible with military sources and are not excessive.

The systems manufactured by Crandall, General Packaging and Scholle are the most compact in size and weight. The Heisler unit incorporates an automated packaging system within a 40-foot covered portable trailer. Some type of vehicle will be required to transport the trailer.

With the exception of Heisler, the other companies have flexible, disposable containers – either plastic bags (General Packaging) or bag-in-box (Crandall and Scholle) configurations. Heisler, on the other hand, uses plastic pails with or without a pop-up spout on the lid. At this time, it is not known whether the plastic pail would affect potability (impart a taste or odor to water) or whether the chlorine disinfectant would affect the plastic during storage (shelf-life). However, the plastic pails are more durable than the plastic bags or bag-in-box. Since the requirements for the system have not been finalized by the user, all options will be considered to determine which system best meets the Army's needs.

General Packaging and Scholle do have monthly leasing programs in place, that would allow the Government to lease versus purchase equipment for testing purposes.

Section 5 Recommendations

Due to funding constraints and a rewrite of the Operational Requirements Document (ORD), this program will essentially be inactive during FY96. Thus, an abbreviated market survey will be necessary (first quarter, FY97) to determine any new technologies within the food/liquid packaging industry and any other potential candidate systems. In addition to the data obtained from the previously distributed questionnaires (see Appendix B), requested information will include the shelf-life of the containers, empty and filled, greater detail of the physical characteristics of the containers with costs, the type of fittings and connections and their compatibility with military components and also, whether the equipment is approved by the National Sanitation Foundation (NSF) or an equivalent organization.

Once the responses from this abbreviated survey have been evaluated, it is recommended that the Army obtain several candidate systems through leasing agreements to evaluate their operational effectiveness and capability to meet the specified requirements. The evaluation should include discussions with the manufacturers to determine if modifications can be made to the systems, allowing them to meet present and future Army requirements.

Appendix A Portable, Commercially Available Water Packaging System—Sources Sought _____

COMMERCE BUSINESS DAILY ISSUE OF AUGUST 22, 1994 PSA#1164

Belvoir Research, Development & Engineering Center, ATTN: STRBE-P
Directorate of Acquisition, Fort Belvoir, VA 22060-5606

A – PORTABLE, COMMERCIALY-AVAILABLE WATER PACKAGING SYSTEM DUE 093094
POC Contact Point, DEBORAH BUTLER, (703) 704-3354
Contracting Officer, ROBERT TOBEY, (703) 704-2199

Sources are sought by the U.S. Army Tank-Automotive Command Mobility Technology Center-Belvoir for a portable, commercially-available water packaging system. The intended use of this system is to package water for distribution in the field following treatment by a reverse osmosis water purification unit (ROWPU). The initial information can be provided in the format of a technical data sheet, technical bulletin or performance data sheet and should include name, model number, and operating specifications. This data will be used to evaluate the potential of the system to meet the requirements to become a component of the Army's field water purification and distribution system. The Government shall not incur any cost for this information. No contract is anticipated at this time, however, at a later date, a limited number could be purchased for test and evaluation.

The packaging water system would consist of a water filling and container sealing device and be designed to facilitate mass production with minimal manual labor. The system must be capable of stand alone operation and meet the military requirements for transportability, NBC survivability, and human factors. The desired capacity should be sufficient to support a 3000 GPH ROWPU or two 600 GPH models. The containers shall be disposable, preferable biodegradable, and be available in six gallons.

For further information or clarification, contact Deborah Butler (703) 704-3354, FAX: (703) 704-3360.

Forward information to: USA TANK AUTOMOTIVE COMD
 MOBILITY TECH CTR BELVOIR
 ATTN: AMSTA-RBWE-A COLEMAN
 10115 Gridley Road, Suite 128
 Ft Belvoir, VA 22060-5818

(National Purchasing system 19940819/A-0010.SOL)

**Beverage Industry Advertisement,
May 1994**

CONTRACT WANTED

Sources are sought by the U.S. Army Tank-Automotive Command Mobility Technology Center-Belvoir for a portable, commercially-available water packaging system. The intended use of this system is to package water for distribution in the field following treatment by a reverse osmosis water purification unit (ROWPU). The initial information can be provided in the format of a Technical Data Sheet, Technical Bulletin or Performance Data Sheet and should include name, model number, and operating specifications. This data will be used to evaluate the potential of the system to meet the requirements to become a component of the Army's field water purification and distribution system. The Government shall not incur any cost for this information. No contract is anticipated at this time, however, at a later date, a limited number could be purchased for test and evaluation.

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For further information or clarification, contact Deborah Butler (703) 704-3354, FAX: (703) 704-3360. Forward information:

USA TANK AUTOMOTIVE COMD
MOBILITY TECH CTR BELVOIR
ATTN: AMSTA-RBWE-A COLEMAN
10115 Gridley Road, Suite 128
Ft Belvoir, VA 22060-5818

**Beverage World Advertisement,
July 1994**

CLASSIFIEDS

MISCELLANEOUS

SOURCES ARE SOUGHT BY THE U.S. Army Tank-Automotive Command Mobility Technology Center-Belvoir for a portable, commercially-available water packaging system. The intended use of this system is to package water for distribution in the field following treatment by a reverse osmosis water purification unit (ROWPU). The initial information can be provided in the format of a Technical Data Sheet, Technical Bulletin or Performance Data Sheet and should include name, model number, and operating specifications. This data will be used to evaluate the potential of the system to meet the requirements to become a component of the Army's field water purification and distribution system. The Government shall not incur any cost for this information. No contract is anticipated at this time, however, at a later date, a limited number could be purchased for test and evaluation.

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For further information or clarification, contact Deborah Butler (703) 704-3354, FAX: (703) 704-3360. Forward information:

USA TANK AUTOMOTIVE COMD
MOBILITY TECH CTR BELVOIR
ATTN: AMSTA-RBWE-A COLEMAN
10115 Gridley Road, Suite 128
Ft Belvoir, VA 22060-5818

**Appendix B Questionnaires/Surveys of
Commercially Available
Water Packaging Systems_____**

**QUESTIONNAIRE/SURVEY
OF COMMERCIALLY AVAILABLE
PACKAGED WATER SYSTEMS
TO SUPPORT THE
TARDEC WATER SUPPLY FIELD OF ENDEAVOR**

This questionnaire is strictly for information to be used by the government only, and will not be made available to any other non-government agency. If there is insufficient space for any of your responses, please continue on a blank sheet of paper. Please annotate the continued response with the appropriate question number and attach the sheet of paper to the end of the questionnaire.

Please list your company's complete name, address, phone, fax, and point of contact for this information.

Please answer the following questions for each system.

1. Physical Characteristics of the System

a. Does your company presently manufacture, and distribute systems capable of automatically packaging liquids?

b. Are these systems portable, or can they be modified for field operations?

c. What are the weight and dimensions of the system?

d. What are the volumes dispensed, and fill rate?

e. What are the power requirements of the system?

f. What type of packages are used in this process, and are they biodegradable?

g. What are the maximum hours of continuous operation under optimal conditions?

h. What is the temperature range for proper operation of the system?

2. Cost and Man-Power of System Operation

a. What is the cost of the Filling Machine?

b. What is the cost of the packaging?

c. How many personnel are required to set up and operate this system?

d. What is the approximate time to set up and initiate operation of the system?

3. Availability

a. Are prototype systems available for leasing?

b. What is the cost to lease on a monthly basis?

Please enclose fact sheets, on your water packaging systems. Include any additional information you deem pertinent, and point of contacts for this information.

**FOLLOW-UP QUESTIONNAIRE/SURVEY
OF COMMERCIALLY AVAILABLE
PACKAGED WATER SYSTEMS
TO SUPPORT THE
TARDEC WATER SUPPLY FIELD OF ENDEAVOR**

This questionnaire is strictly for information to be used by the government only and will not be made available to any other non-government agency. If there is insufficient space provided for any of your responses, please continue on a blank sheet with the appropriate question number and attach to the end of the questionnaire.

Please list your company's complete name, address, phone, fax and point of contact for this information in the space provided below:

FOLLOW-UP QUESTIONNAIRE FOR PACKAGED WATER

Please answer the following questions for each applicable system:

1. What are the dimensions of your complete, functional water packaging system?

2. What are the major components of your system?

3. List all supplies (containers, etc...) with quantities, required for 100 hours of sustained operation.

4. Does your company currently have this packaging system available for demonstration?

5. Would your company be willing to demonstrate (using company personnel and supplies) the water packaging system?

6. Please explain, separately, the cost breakdown for leasing your system on a monthly basis. Cost breakdown should include costs for support equipment, if any and supplies, spare parts and any additional costs associated with the lease. Please feel free to attach a copy of any previous leasing agreement.

7. How many man hours are required to stop operation, clean and pack your system for shipment and/or storage?

8. Is it possible to containerize your packaging system for shipment and/or storage in Tricon containers (88.5"x 71.5"x 86.5"- minimal inside dimensions)?

9. If the answer to question 8 is NO, would your company be willing to reconfigure your system to fit in the standard Tricon containers?

10. List any tools and support equipment (including test measurement and diagnostic equipment) required to attach, detach and perform maintenance on your packaging system.

11. What skills are required to operate and maintain your packaging system? (Please provide a brief description of education, training and/or technical background requirements.) Is the required training available from any source besides yourself?

12. Does your packaging system meet OSHA safety standards for operation and maintenance?

13. Does the system have any effluent streams that do not meet NPDES?

14. What variables such as temperature, flowrate, etc., affect your packaging system process?

15. What operation and maintenance manuals do you have for your packaging system and are any available in military format?

16. Do any of the components of your packaging system require calibration? If so explain.

17. How long has the item been on the commercial market? How many are in commercial use? What are the prospects for product longevity? How long will you support it?

18. Is there a competitive market for contract repair and support of the proposed item, or is it restricted to a single source?

19. Is the proposed equipment covered by a warranty? What are the warranty's provisions? If your product will reach the government through a prime contractor, will your warranty carry through with it?

20. Identify at least three commercial users of your product. Also, name current military customers, if any.

21. What is your estimate of your product's life cycle cost over a 15 - 20 year time period?

Appendix C Companies Contacted and Distribution List for the Market Survey_____

Companies Contacted by Mail, Fax or Telephone for the Market Survey

1. Scholle Corporation
2. General Packaging
3. Atlantic Foods
4. Crandall Filling Machinery, Inc.
5. Packaging Machinery Manufactures Institute (PMMI)
6. Fowler Products Company
7. Horix Manufacturing Company
8. Ideal MFG. & Sales Corp.
9. Electronic Liquid Fillers, Inc.
10. Osgood Industries, Inc.
11. Packaging Dynamics, LTD.
12. Mateer-Burt Company, Inc.
13. Oden Corporation
14. Bag-a-Thon Corp.
15. Design Technology Corp.
16. Bemis Industries
17. Expomatik
18. Phoenix Engineering
19. Automated Packaging
20. All-Fill
21. National Instrument Company
22. Bernard Laboratory
23. Lin-Pak
24. Packaging by Design
25. Main-Pack Corporation
26. Prodo-Pak Corporation
27. Pak-Rapid, Inc.
28. Quality Packaging Systems
29. Haver Filling Systems

30. Krones, Inc.
31. Unette Corp.
32. Franklin, Inc.
33. Ultra-Seal
34. Dupont
35. Clinical Packaging
36. Associated Packaging
37. Advanced Manufacturing Systems
38. Special Products and Design
39. Main-Pack Corporation
40. Doerfer Engineering
41. Packaging Consultants
42. The Noble Corporation
43. ASI Packaging
44. Simplex Filler Co.
45. Thiel Engineering
46. Beverage Machine
47. Beverage Canners
48. Bottlers Supply
49. Dairy Equipment
50. Fogg Filler
51. Packaging Lines Systems
52. Steven Gould of Maryland
53. PCA
54. Berlin Packaging
55. Georgia-Pacific
56. All-Pak
57. Quality Packaging Systems
58. Bulk-Bag
59. Flex-Con & Systems, Inc.
60. Peabody Corporation
61. Packaging Corporation of America
62. National Packaging Service

Distribution List for Questionnaires

B&T PACKAGING MACHINERY
DIVISION OF B&T SALES LTD.
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FAX (808) 982-5303

BRUDERLY ENGINEERING ASSOCIATES, INC.
1826 N.W. 57TH TERRACE
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POC: MR. DAVID E. BRUDERLY, P.E. (904) 377-0932
FAX (904) 378-6326

CAN-FLEX
10 STATE STREET
WOBURN, MASSACHUSETTS
POC: MR. JIM VICEDOMINE

CRANDALL FILLING MACHINERY, INC.
1392 NIAGARA STREET
BUFFALO, NEW YORK 14213-1393
POC: MR. DAVE REED (716) 885-2228
FAX (716) 882-6649

FILLER SPECIALTIES
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ZEELAND, MICHIGAN 49464
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WESTMONT, IL 60559-0327

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PHILIP TIMMONS, INC.

5523 WEST LEDBETTER DRIVE

DALLAS, TX 75236-1303

SCHOLLE CORPORATION

200 W. NORTH AVENUE

NORTHLAKE, IL 60164

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FAX (708) 409-9349

SEP TECH ENVIRONMENTAL, INC.

816-C AIRPORT ROAD

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845 HARRINGTON COURT

BURLINGTON, ONTARIO

CANADA L7N3P3

Appendix D Mission Needs Statement (MNS) for Packaged Water System (PWS)

Mission Need Statement

For Packaged Water System (PWS)

1. Defense Planning Guidance Element. Headquarters, U.S. Army Training and Doctrine Command Battlefield Development Plan (BDP) 94-08 (7 Jan 91), priority number 43, supports the need for a PWS.

2. Mission and Threat Analysis. Current Army doctrine specifies supply point distribution as the primary means of providing potable water once the theater is established. During the deployment phase, the first elements entering into an area of operations may be combat forces with little or no significant combat service support (CSS). These units will carry only sufficient quantities of water for immediate survival purposes. Resupply of these forces will be provided primarily by aerial delivery of prepackaged water from host country support bases. The present non-expendable equipment used for aerial resupply, such as 5 gallon cans, and 55-, 250-, and 500-gallon drums, must be continuously recovered and reused. Therefore, this non-expendable equipment will not satisfy a situation where the equipment cannot be recovered. During the lodgement and build-up phases, a capability for aerial water resupply for isolated task forces with no ground lines of communication must be maintained. The PWS will provide this capability for an expendable means of water resupply. Current water distribution capability will not be replaced by the PWS. Instead, the PWS will supplement the current water distribution system to meet water requirements during the early phases of operations and tactical emergencies. For example, packaged water can be used to resupply units operation in a nuclear, biological and chemical (NBC) environment. Currently, soldiers must drink from their canteens in an NBC environment. In accordance with (IAW) Field Manual 21-40, current doctrine states canteens must be retrieved, decontaminated and refilled with water in a clean environment, then returned to soldiers in the NBC environment. Since canteens are non-expendable items, this method of resupplying water to units in a NBC environment is manpower intensive and time consuming at best. Instead, PWS can be employed to resupply units in a NBC environment with packaged water in flexible, disposable containers. Although PWS does not counter any specific threat, it will provide an increased capability to provide potable water in all phases of operations and differing environments. PWS and its associated personnel are vulnerable to the spectrum of threat destruction/disruptive capabilities at all levels of conflict along the operation continuum. Major threats are a result of its proximity to targets in the battalion, brigade, and division rears. Though unlikely, PWS may also be attacked as a target of opportunity. Destructive capabilities such as direct and indirect fires, small arms fire, and sabotage can harm the system and associated personnel. PWS will also be susceptible to contamination. NBC warfare operations and weapons effects may render the system temporarily unusable or destroy it.

3. Non-materiel Alternatives. Doctrine, training, leadership, and organization have been reviewed for possible solutions: none were found that will yield a nonexpendable means of supplying water. The only nonmateriel alternatives are doctrinal. They are to either use host nation bottled water support within the area of operation or fill canteens and five-gallon containers at water purification sites and distribute them like bottled water. The constraints associated with filling and distributing nonexpendable containers were discussed in paragraph 2. Host nation bottled water support cannot be assured in all regions of the world because it requires the protection of the source, bottling facilities with an adequate capacity, standards of hygiene which meet U.S. Army standards, and a secure means of transport by friendly forces. It also assumes a safe level of water quality in host nation bottled water. However, many third world nations have severe water quality problems.

4. Potential Materiel Alternatives. There may also be a potential for interservice or allied cooperation. Alternatives are: do nothing and rely on our current water supply/distribution methods; adapt commercial PWS to U.S. Army requirements; to develop the means to fill, deliver, and recover large quantities of canteens and/or five-gallon containers; or keep adequate reserve stocks of bottled/package water in the inventory for contingency operations throughout the world.

5. Constraints. The PWS must comply with industry and government safety and health hazard standards and must not present any uncontrolled safety or health hazards throughout the life cycle of the system. The PWS must permit cleaning, disinfection, decontamination, and inspection of components. The PWS will provide potable water which meets U.S. Army field water quality standards as established in the tri-service agreement on short term field water

quality standards. It will also provide water which meets U.S. Army field water quality standards while operating in an NBC environment. The packaged potable water shall be protected against NBC contamination and decontaminating agents. Packaged water will be compatible with the NBC protective mask drinking system, and the soldier must be able to drink packaged water while in the mission-oriented protective posture (MOPP) IV ensemble. Packaged water must be cross country transportable by air and land vehicles organic to U.S. Army units. Also, supplies necessary to operate water packaging equipment must be transportable by cargo vehicles, including the high mobility, multipurpose, wheeled vehicle, which is organic to U.S. Army water units. Individual packages of water must be durable enough to withstand not only bulk storage and transport, but also storage by the individual soldier. The packaged water must be able to be rapidly moved and transferred with the use of materiel handling equipment (MHE). Equipment and packaged water must be airdroppable. The filling and packaging equipment must be operable and maintainable by organic U.S. Army water unit personnel; and it will be supported IAW the Army's standard, four-level maintenance system. The PWS must be supported by the standard Army logistics system, and only standard tools will be used. No special tools, new tools, or test and diagnostic equipment will be required to support the PWS. The addition of the PWS makes greater demand on the water treatment specialist; an increase in manpower may be needed when utilizing water purification equipment and the PWS at the same time. To the degree possible, the PWS must be capable of interoperability with current North Atlantic Treaty Organization water purification equipment and methods since various allied nations have expressed an interest in this project. Packaged water must be compatible with the supply system to allow for distribution through normal Class I and II supply channels as an item of dry cargo. Packaging equipment and packages must be capable of being stored and transported in climactic environments cold, basic, and hot without additional protection (i.e., shelters). Institutional and unit training will be required for operator personnel.

6. Joint Potential Designator. The Air Force has recommended this mission need be designated as "Joint Interest."

Distribution List For Technical Report_____

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